The Next Step for Next Generation Technology: Interconnecting Managed Packet Networks to Preserve Voice Service Quality and Competition

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Executive Summary

Packet technology is the future of voice communications. A key development in packet technology – the emergence of carrier-designed "Managed Packet" networks – is beginning to transform the traditional public switched telephone network ("PSTN") into an all-packet environment. Managed Packet networks are noteworthy because (among other features) they apply specific instructions to the routing of voice packets, thereby combining the efficiency of packet technology with the quality and reliability of the legacy circuit-switched voice network.

To be clear, Managed Packet networks should not be confused with the Internet or retail VoIP services. Managed Packet networks are fundamentally different from the public Internet, where packets move on a best efforts basis, with associated deficiencies in quality and security. Managed Packet networks are carrier-grade facilities, replacing traditional circuit-switched networks. These networks permit the quality-of-service levels needed for voice service, while retaining the capability to support other data streams and services as well. Managed Packet technology thus offers unparalleled flexibility and cost savings over traditional transport platforms.

The evolution in technology to Managed Packet networks, however, should not diminish the universal interconnected nature of voice networks. Most importantly, incumbent local telephone companies should be required to interconnect their Managed Packet network facilities with competitors, just as they are required to interconnect with competing circuit-switched networks today. Any other conclusion would discourage investment in packet networks, deter broadband deployment, and risk degradation of voice service quality and competition.

Despite the clear advantages that come from directly interconnecting Managed Packet networks, competitors thus far have had to convert packet-voice traffic to its legacy circuit-switched form to interconnect with incumbents. ILECs appear to be imposing this requirement even though they are actively deploying Managed Packet transport networks themselves, and even though the direct interconnection of Managed Packet carrier networks for the exchange of voice traffic (i.e., without conversion to legacy form) is not only possible but more efficient.

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Furthermore, early indications suggest that at least some ILECs are taking the position that their interconnection obligations only apply in a circuit-switched world. These ILECs apparently claim that Sections 251 and 252 of the Telecommunications Act only apply to circuit-switched networks, and that those obligations drop away as ILECs (and other carriers) evolve to Managed Packet transport facilities. These ILECs assert an absolute right to set the terms of Managed Packet interconnection without any regulatory oversight, and without regard to their continuing market power.

The Telecommunications Act, however, recognizes that an ILEC's dominance is a consequence of its historically-derived market position, and not the particular equipment and network facilities it uses over time. There is no basis for the ILEC's claim that its interconnection obligations evaporate merely because it has deployed a different transport architecture.

The technical parameters and business rules for the exchange of voice traffic between traditional circuit-switched networks are well established, but did not become so without controversy and oversight. The Telecommunications Act, and the regulatory backstop it provides, have been crucial to this process. Going forward, the basic elements of interconnection – i.e., the physical link, interface, signaling and database access – will be just as important to Managed Packet networks as they have been to traditional circuit-switched facilities, even if the particulars of each differ. And similarly, the role of regulators as backstops to interconnection negotiation will remain crucial in a Managed Packet environment.

I. Introduction

The voice communications industry stands at the brink of fundamental change. A transformative technology – Managed Packet – is enabling carriers to apply specific routing protocols to voice packets, thereby combining the quality-of-service of the traditional voice network with the efficiency and flexibility of packet-based networks. Networks now can transport real-time voice services alongside data services in packet-based format without sacrificing quality, reliability and security.[2]

[2] It is important to make clear at the outset that the Managed Packet networks that are the focus of this paper are not, and should not be confused with, the Internet, with respect to the operations and policies appropriate to each. First, Managed Packet *carrier networks* are not the same as the *public Internet*. Because Managed Packet networks frequently share a common protocol with the Internet – an IP protocol favored because of its open standards and the widespread availability of equipment – the networks are sometimes confused as one. The fact that Managed Packet networks use the same protocol as the Internet, however, does not mean that such networks make use of the Internet, anymore than an F-14 becomes part of the Commercial Air Transport System, merely because both it and commercial passenger aircraft rely on the same physical law (Bernoulli's Principle) for lift. Nor do these networks "peer" in the way that public Internet backbone providers exchange packets on a best efforts basis.

Managed Packet technology holds the promise of lower prices and exciting new services for consumers and businesses. Cable companies and other competitive carriers are leading the deployment of Managed Packet Networks that support voice service at defined levels of quality. ILECs, especially the largest carriers such as AT&T and Verizon, also are actively deploying Managed Packet technology to reduce costs and obtain new functionality. Managed Packet is already widespread in ILEC transport networks and will increasingly support end-to-end applications as local broadband connectivity expands.

The purpose of this paper is to explain the benefits of Managed Packet technology and the importance of establishing efficient and cost-based Managed Packet voice traffic exchange arrangements between entrants and incumbents. Efficient interconnection of Managed Packet networks is necessary to ensure that the voice quality expected by consumers continues, while accommodating the new services made possible by this transformative technology. Such interconnection is an absolute precondition to the end-to-end digital broadband network that is this nation's goal, and its implementation would accelerate the deployment of broadband networks while simultaneously positioning those networks for more efficient operation.

But a potential cloud is on the horizon. Some ILECs have suggested that their obligation to interconnect with competitors to exchange voice traffic is limited to circuit-switched facilities, and evaporates as they replace their local networks with Managed Packet technology. This position is inconsistent with the Telecommunications Act, and the technical feasibility standard of Section 251. It will be important for regulators to speak clearly in defense of their powers (and the ILECs' obligations) to ensure competitive interconnection in the evolving Managed Packet environment. Doing so will minimize unnecessary controversy in this area, and advance the nation's interest in broader deployment of next generation networks.

Second, and similarly, it is important to distinguish the voice services provided over Managed Packet networks from "*over the top*" Voice over Internet Protocol ("VoIP") offerings (such as that offered by Vonage) that rely, in whole or in part, on the "best efforts" public Internet. Confusion can arise because the provision of voice service over a Managed Packet network also is sometimes referred to as "VoIP." But carriers design their Managed Packet networks, among other reasons, specifically to enable voice transport service with the quality associated with the traditional circuit-switched PSTN. In contrast, "over the top" VoIP offerings relying on the Internet cannot carry service quality commitments, including those associated with time of delivery, accuracy, or security.

Finally, it is not necessarily uncommon for the same transport infrastructure to be used for Managed Packet and Internet services, just as it is not uncommon for the same physical plant to be used to provide switched services and private line services in the traditional phone network. But this does should not alter the interconnection laws and policies applicable as the PSTN moves to Managed Packet technology.

To be clear, the continuing need for a regulatory backstop to negotiations for *wholesale* voice traffic exchange has no bearing on whether or how *retail* voice services offered to end users are regulated. Regulation of IP-enabled retail voice services is a matter of ongoing debate, both as to the social policy obligations that such services should bear (such as universal service contribution, E911 or CALEA) and as to whether any entry or economic regulation should apply to them. But importantly, those questions are independent of the issue addressed here: How carriers should interconnect their Managed Packet networks, and what regulatory obligations ILECs (and other requesting carriers) bear in that context?

II. A Primer on the Evolution of Managed Packet Voice Networks

To understand the importance of interconnecting Managed Packet networks for the exchange of voice traffic, it is useful to start with a brief discussion of exactly what a Managed Packet network (also called a Next Generation network) is, and how it differs from a traditional circuit-switched network.[3] In lay terms, the critical features of a Managed Packet network are that: (a) the network is *packet*-based (most likely based on the same protocols employed by the Internet);[4] (b) the network has the ability to assign a *specific* routing priority to voice service (and is thus able to support defined service quality); and, (c) the network operates in a manner that defines the service *independently* of the transport technology.[5]

The basic elements of a Managed Packet voice call involve a series of steps, some familiar, others new. As with the legacy phone network, the network first accommodates the fact that humans speak in analog waves, thereby (like today's network) requiring conversion to digital form. Consequently, the first step in the process (as with the legacy network) is that the voice call (termed "media" in this context) is converted to digital form. Unlike the traditional phone network, however, which controls call paths from a centralized node that establishes a constant bit-rate (typically 64kbps) path from start to destination, a Managed Packet network relies on the originating end-point to "invite" the terminating end-point to an agreed-upon session.

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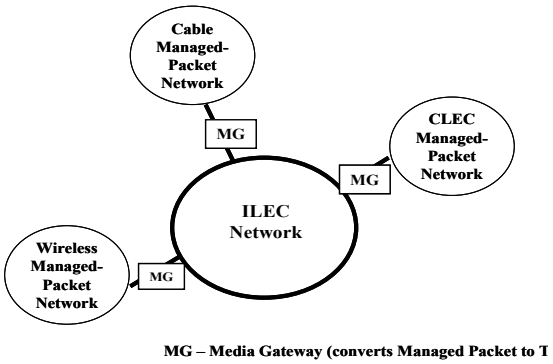
[3] It is somewhat unfortunate that the industry adopted the term "Next Generation" as the label of choice for this particular technological advancement. The term suggests that the technology is "on the horizon" when, in fact, it is readily available and being actively deployed today.

[4] Manufacturers commonly develop equipment for Managed Packet networks with an eye towards the open standards and large market potential for internet-compatible technology.

[5] http://www.itu.int/ITUT/studygroups/com13/ngn2004/working_definition.html

Figure 1: First Stage Deployment of Managed Packet Networks



The most common protocol used to establish and manage these sessions is the "Session Initiation Protocol" or SIP.[6] Call Agents (sometimes known as "user agents" when located at the customer premise) establish the sessions between the requested end-points, identify the packets as relating to voice service, and release the call into the transport layer for actual transmission. Within a single carrier's network, these agents access the necessary databases and end-points to manage packet flows so as to provide subscribers with the appropriate quality of service ("QoS") for a real-time application such as voice.[7]

As represented in Figure 1, the first stage in the deployment of Managed Packet voice networks has occurred in the form of isolated islands in which individual companies have been able to ensure *within*-network QoS for their voice products. The problem has come when traffic leaves the Managed Packet network "island" for termination on another network, particularly a legacy circuit-switched transport network of the incumbent. During these early days of Managed Packet deployment, these next-generation networks have had to adapt to the legacy network by giving up the advantages of packet transport. To reach the large majority of subscribers still served by an incumbent, entrant-networks have been designed to impersonate legacy facilities by converting to TDM-format at the edge as a requirement for interconnection to the ILEC.[8] See Figure 2 (following page). Thus, the benefits of Managed Packet technology today stop at the voice network owner's gate because traffic exchange arrangements that would maintain the voice service in Managed Packet form are not yet in place.

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[6] Other protocols exist, including H.323, which is a protocol based on an early recommendation from the ITU. Media Gateways have the ability to bridge networks relying on different protocols.

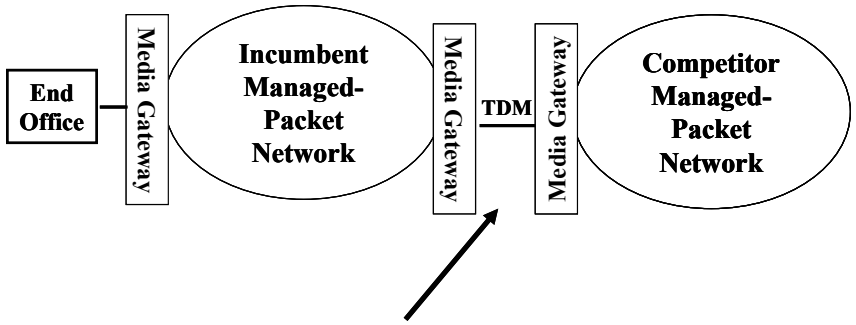
[7] A database critical to a Managed Packet voice architecture is the ENUM registry that maintains the location and routing information of network subscribers. ENUM is derived from the term "T*E*lephone *NU*mber *M*apping," and is a suite of protocols developed by the IETF to unify the traditional telephone numbering system and the Internet addressing system using an indirect lookup method.

[8] Time Division Multiplexing ("TDM") is the method by which voice traffic is assigned a time-defined circuit on a digital network. By assigning a specific time-slot to an individual conversation, TDM reserves a "circuit" for the continuous transmission of the digital bytes associated with a particular phone call. As the terms are used in this paper, "TDM" and "circuit-switched" are interchangeable.

III. The Next Step: The Interconnection of Managed Packet Networks

Importantly, the era of "Managed Packet islands," with its inherent inefficiency, is coming to a close. Managed Packet technology not only supports *within*-network voice QoS; the technology also enables the seamless *exchange* of voice packets between networks in a manner that respects the priority requirements of each. In this way, quality voice service is possible not only within the Managed Packet network of a single carrier, but can be provided across networks on an end-to-end basis.

Figure 2: An Inefficient Interconnection Between Managed Packet Transport Networks Using TDM Conversion



The participants most critical to the development of Managed Packet traffic exchange arrangements, however, are the incumbent local exchange carriers that have the largest base of voice subscribers – and therefore control the largest volume of exchanged voice traffic[9] – in their respective regions. Most significantly, the incumbents are *themselves* actively deploying Managed Packet networks, thereby obviating the need to rely on legacy technology for interconnection arrangements between neighboring Next-Generation networks.

Requiring a Managed Packet network to mimic legacy circuit-switched facilities to interconnect -- especially where the incumbent itself has deployed a Managed Packet transport network[10] -- increases cost, reduces quality and discourages the wider

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[9] Interconnection volume is generally related to market share, with local traffic representing the largest category of traffic exchanged between carriers. As such, the key to Managed Packet traffic exchange will be the manner in which the Managed Packet networks of competitors are interconnected to the Managed Packet networks of incumbents.

[10] The benefits made possible by interconnecting Managed Packet networks in their native packet form are not limited to the traffic of customers that have subscribed to packet-based services. Significant efficiencies can be achieved wherever the incumbent has deployed a

deployment of Next Generation networks and applications by diverting investment to what is, *at best*, a valueless activity.[11]

The ILECs, and particularly AT&T and Verizon, are aggressively deploying Managed Packet networks as substitutes for their older circuit-switched technology, initially in their transport networks but also increasingly to the customer premise. This trend, in which the traditional PSTN is replaced by a Managed Packet network, is irreversible. As explained by Ralph de la Vega, AT&T Group President, Regional Telecommunications and Entertainment: "Customers just want voice to work, whether it's VoIP or not. It's a big step forward for us because we're putting all our services -- U-verse TV, broadband, voice -- over the same IP (Internet protocol) infrastructure using the same billing system. It begins a transition to the future where we can dismantle the (older) voice circuits."[12]

Where an incumbent has deployed a Managed Packet transport network,[13] its legacy circuit-switched transport capacity will either be devoted to low-priority applications where efficiency is not the goal, or retired altogether.[14] If efficiency were its only goal, the incumbent would want to transport the competitor's traffic using its Managed Packet transport capacity to achieve cost savings and maximize scale. Once the incumbent has deployed a Managed Packet transport network, even that carrier would incur unnecessary costs if voice traffic must go through a two-step conversion process -- from Managed Packet to TDM and then immediately from TDM back to Managed Packet -- as part of traveling between two Managed Packet transport networks. Such an approach requires back-to-back media gateways that perform the protocol conversions, increasing

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Managed Packet *transport* network, even as most of its subscribers continue to be served using legacy (i.e., circuit-switched) end offices.

[11] Although this paper focuses on the efficiency gains possible by the direct interconnection of Managed Packet transport networks (i.e., interconnection without conversion to legacy form), it is also important to understand that the conversion of a packet-call to a circuit-switched format strips the call of any packet-enabled functionality. Thus, the conversion compounds the drag on economic efficiency by increasing cost and making the service less useful.

[12] *AT&T Set To Include Internet Telephony in Product Bundles*, Investor's Business Daily, October 1, 2007.

[13] This paper does not suggest that an incumbent should be required to deploy a Managed Packet transport network to accommodate competitive entrants where it has not done so. However, as discussed above, incumbents already are deploying Managed Packet transport networks for their own purposes to take advantage of network efficiencies and position themselves to offer new services to their subscribers.

[14] Obviously, to the extent that the incumbent relegates its legacy transport network to marginal uses, it would be discriminatory for one such use to be the "transport and termination" of a rival's voice traffic.

cost while degrading voice signal quality, all to effect a conversion that is neither efficient nor required.[15]

Investment in unneeded media gateways to convert Managed Packet traffic to legacy format is wasteful and counterproductive. Such conversions are nothing more than engineering "busy work," adding no value.[16] In addition to being inefficient, the unnecessary conversions impose higher operational costs by requiring carriers to manage both the logical networks that define the Next-Generation architecture and the physical networks that characterize the legacy approach. Spending scarce capital in such a wasteful exercise runs counter to sound economics and rational public policy. Every dollar diverted to an unnecessary task is a dollar that would otherwise be available to expand the carrier's Managed Packet network, increasing the availability of advanced services.

Equally troubling are the indirect costs associated with conforming to legacy architectural rules, including requirements to establish "dedicated" trunks to certain end offices, one-way trunk groups, or specific trunks for particular types of traffic.[17] These network restrictions are grounded in the past and have no reason to exist in a packet environment.[18]

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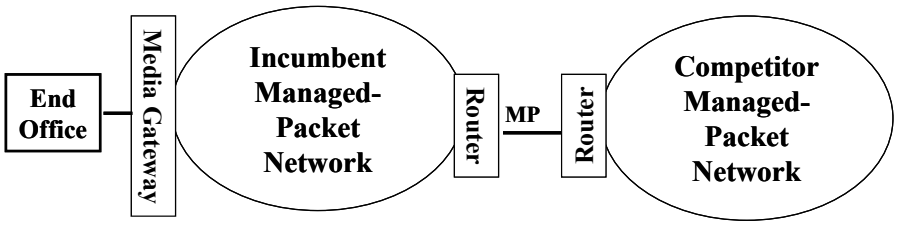
[15] One would hope that incumbents would eventually welcome the exchange of voice traffic in packet form, as the incumbent's Managed Packet transport networks replace their circuit-switched architecture of the past. Early in the adoption of such arrangements, however, incumbents have the incentive to impose additional costs on rivals that have deployed more efficient Managed Packet technology by requiring that competitive entrants interconnect through the incumbent's obsolete circuit-switched technology, even where a more efficient Managed Packet transport facility is available.

[16] Converting Managed Packet packets to a TDM bit rate – only to be converted back to Managed Packet form for transport in the ILEC's own Managed Packet network – also reduces voice quality through unnecessary protocol conversion.

[17] The deployment of Managed Packet technology has implications for other issues. For instance, legacy interconnection arrangements commonly require that carriers separate "local" and "toll" traffic, as well as establish separate trunk groups for originating and terminating calls. There is simply no reason to allow such practices to reduce the efficiency of packet networks by continuing these requirements in perpetuity. This is separate from the question of how compensation for traffic termination should be assessed. This paper focuses on network interconnection, not intercarrier compensation, and the former does not presuppose any particular rules for the latter. Moreover, the vast majority of traffic poised to benefit by the interconnection of Managed Packet networks is local traffic, where compensation issues are less contentious.

[18] Another example of artificial boundaries that haunt the architecture of legacy networks and interconnection arrangements are the Local Access and Transport Area (LATA) boundaries. Such boundaries, drawn 25 years ago as part of the AT&T divestiture, no longer constrain the RBOCs and should play no further role in defining the scope of interconnection. When drawn, such boundaries were "first approximations" of the subscriber concentrations needed to support long distance entry given the technology of the time (microwave). LATA boundaries answer

**Figure 3: The Next Step in the Evolution to a Packet Future --
Interconnection Between Managed Packet Networks in Packet Form**



Unnecessary conversion to TDM can be avoided, with traffic exchanged between Managed-Packet Networks in packet form, with QoS established end-to-end.

It is important that interconnection arrangements between Managed Packet networks not be forced to conform to legacy policies merely because they once applied to the circuit-switched network. When traditional voice interconnection arrangements were first deployed, the incumbent's network "occupied the field" and interconnection points were generally established in geographic proximity to its network. Today, however, privately operated "carrier hotels" have been specifically constructed in many areas to facilitate interconnection, with expansive "meet point" rooms designed for this very purpose. The incumbent is typically located at such facilities, alongside most carriers providing service in that area. All forms of interconnection should be encouraged at such locations, including interconnection between the Managed Packet networks of incumbents and their competitors.

Finally, establishing direct connections between the Managed Packet networks of incumbents and entrants for voice will accelerate the development of innovative new services that are only possible when a packet-architecture is maintained throughout the communication end-to-end (*i.e.*, both end points subscribe to an packet-based service). Although Managed Packet interconnection with the ILEC will initially unleash the efficiencies inherent in these Managed Packet *transport* networks that have been deployed, both Verizon (and, to a lesser extent, AT&T) are beginning to establish a base of packet-enabled subscribers.[19] Over time, the realized benefits of Managed Packet interconnection will be determined more from the innovations made possible by *end-to-end* Managed Packet services over different Managed Packet networks, than from the

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poorly the wrong question for the wrong century, and cannot be reliably used to define any parameter relevant to the interconnection of Managed Packet networks today.

[19] Subscribers to Verizon's FiOS service -- and, more recently, AT&T's UVerse network – receive packet-based voice service all the way to the customer's premise.

cost efficiencies that can be realized by establishing direct interconnection between Managed Packet *transport* networks today.

These issues are not hypothetical. AT&T has made clear that its goal is to replace its circuit-switched network with packet technology, pointing "to the future where we [AT&T] can dismantle the (older) voice circuits."[20] Verizon has been replacing its circuit switches with soft switches as part of deploying its Managed Packet transport network, yet advising others that they must continue to interconnect in legacy form.[21] The nation's march to an all-packet, digital broadband future must soon include interconnection between these modern Managed Packet networks on nondiscriminatory terms, just as interconnection and traffic exchange arrangements were needed between circuit-switched networks in the past.

IV. Interconnection of Managed Packet Networks Under Sections 251 and 252

The legal foundations for the interconnection of next generation Managed Packet networks already are anticipated in existing telecommunications law. This is not surprising, for the policy concerns underlying the law are technologically neutral and designed to accommodate the evolution of technology over time.

Nevertheless, at least some ILECs appear to be taking the position that they have no legal obligation to interconnect with CLECs as these incumbents substitute Managed IP for circuit-switched transport technology. For example, Verizon has asserted that it would be a "radical change" to require ILECs to interconnect with CLECs outside of a circuit-switched environment. Verizon made this comment in response to a seemingly unexceptional statement by the National Cable & Telecommunications Association ("NCTA") in the context of comments on a Verizon forbearance petition. NCTA had observed that:

> Congress imposed mandatory interconnection obligations on ILECs pursuant to Section 251 in recognition of the fact that they alone have ubiquitous local networks. .... The fact that an ILEC is in the process of transitioning from a circuit-switched, copper-based network to an IP/packet/broadband/optical network does nothing to diminish the advantage of ubiquity or the potential exercise of market power over interconnection that would arise in the absence of regulation. For example, it should not be the case that an ILEC can avoid all Title II obligations, including interconnection obligations, merely by replacing a TDM switch

[20] *See* note 12 *supra*.

[21] For instance, Verizon announced the replacement of a number of DMS 100 switches in California with Nortel's Succession Packet Switches (*see* Notice of Network Change, Verizon, June 15, 2004). Similar changes have been announced in other states. The common denominator, however, has been that "Verizon will use a trunk gateway to interface with the packet switches so that the existing means of interconnection will be unchanged."

> with a packet switch. Under Section 251(c)(2), ILECs are required to permit interconnection where it is technically feasible. The statute contains no exception for IP/packet/broadband/optical technology and there is no reason for the Commission to create one, particularly considering the ongoing migration by ILECs and other providers to IP-based softswitch technology.[22]

Verizon, however, was quick to respond to NCTA's comment, aggressively challenging the observation that Section 251 continues to apply in a Managed Packet environment. Verizon characterized NCTA's position as "radical" and unsupported by law. Verizon accused NCTA of "seeking to expand the scope of [Sections 251 and 252] to impose legal interconnection and traffic exchange mandates on IP networks — thereby regulating for the first time a currently unregulated and highly competitive market segment, contrary to the requirements of the 1996 Act and Commission policy — such radical changes" that are beyond the FCC's authority.[23] AT&T has committed less to paper, but has echoed these same themes in public discussions addressing Managed Packet interconnection.

It is understandable why the ILECs would want to escape their statutory interconnection duties. However, the basis for the ILEC obligations – their disproportionate share of voice subscribers – is not eliminated simply because the technology used to transport the traffic has evolved. The Telecommunications Act specifically anticipated the need for efficient interconnection new technologies, such as the "next-generation" Managed Packet networks discussed here.

For example, as NCTA noted, Section 251(c)(2) allows requesting carriers with the right to interconnect with an ILEC's network on technology neutral grounds. Nothing in that statute limits its application to the network facilities of the ILECs as they stood in 1996. To the contrary, by allowing interconnection at "any technically feasible point" pursuant to Section 251(c)(2)(B), the Act contemplates that, as technology evolves, the scope of what is "feasible" also will evolve.

No one can argue that direct interconnection of Managed Packet networks is not feasible today. As the FCC stated in its initial order implementing the Act, "successful interconnection ... at a particular point in a network, using particular facilities, is substantial evidence that interconnection or access is technically feasible at that point, or at substantially similar points in networks employing substantially similar facilities. In comparing networks for this purpose, the substantial similarity of network facilities may

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[22] Letter of the National Cable & Telecommunications Association, Federal Communications Commission, WC Docket No. 04-440, at 5 (Aug. 6, 2007) (emphasis added).

[23] Opposition of Verizon, Federal Communications Commission, WC Docket No. 04-440, at 11-12 n.19 (Aug. 13, 2007).

be evidenced, for example, by their adherence to the same interface or protocol standards."[24]

Furthermore, the Telecommunications Act provides that ILECs must provide operators of Managed Packet networks the same quality of interconnection that they provide to themselves and their affiliates. *See* Section 251(c)(2)(C). This non-discrimination standard was adopted to ensure that as network technology advances, and is implemented in the ILEC network, other network operators similarly can implement such technology and interconnect their voice networks on an economically efficient basis, notwithstanding the market power otherwise held by the ILEC. Thus, as ILECs interconnect their own Managed Packet network facilities, they also have an obligation to interconnect with third party CLECs.

Finally, the Telecommunications Act provides a duty on the part of both the ILEC and the requesting interconnecting carrier to exchange traffic for transport and termination on a reciprocal basis. *See* Section 251(b)(5). This provision also is technologically neutral, and therefore creates an obligation on the part of one carrier to accept and transmit the Managed Packet voice traffic of another on reasonable and reciprocal terms.

The FCC has properly taken pains to preserve network interconnection obligations, even in situations where it otherwise has been willing to give ILECs regulatory relief. For example, the Commission recently granted certain ILECs forbearance from regulation of their packet-switched broadband services.[25] But at the same time, the FCC made clear that this relief did not in any way impact the ILECs' interconnection obligations under Section 251 and 252. As the Commission observed, interconnection obligations "foster the open and interconnected nature of our communications system, and thus promote competitive market conditions" in the public interest. [26] Similarly, the FCC stated in the *Omaha Forbearance Order*, eliminating interconnection-related obligations would give an ILEC "the ability to exercise market power over interconnection."[27]

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[24] *First Report and Order, Implementation of Local Competition Provisions in the Telecommunications Act of 1996*, 11 FCC Rcd 15499, 15606 (1996) (emphasis added).

[25] *Memorandum Opinion and Order, Petition of AT&T for Forbearance Under47 U.S.C. § 160(c) from Title II and Computer Inquiry Rules with Respect to its Broadband Service*s, FCC 07-180, at para.12 (Oct. 12, 2007) ("*AT&T Forbearance Order*"); *Memorandum Opinion and Order, Petition of ACS of Anchorage, Inc. Pursuant to Section 10 of the Communications Act of 1934, as amended, for Forbearance from Certain Dominant Carrier Regulation of its Interstate Access Services and for Forbearance from Title II Regulation of its Broadband Services, in the Anchorage Alaska, Incumbent Local Exchange Carrier Study Area*, WC Docket No. 06-109, FCC 07-149, at para. 129 (rel. Aug. 20, 2007);

[26] *AT&T Forbearance Order*, supra, at para. 68.

[27] *Memorandum Opinion and Order, Petition of Qwest Corporation for Forbearance Pursuant to 47 U.S.C. § 160(c) in the Omaha Metropolitan Statistical Area*, WC Docket No. 04-

Direct interconnection of Managed Packet networks also is supported by Section 706 of the Telecommunications Act. Section 706 creates a general obligation on the FCC and state regulators to promote the deployment of broadband infrastructure, and that requirement directly implicates the interconnection of independent Managed Packet networks.[28] It is stating the obvious to observe that broadband networks are advanced by interconnection policies that support efficient voice traffic exchange, including Managed Packet traffic meeting quality of service expectations of end users. Conversely, refusals to interconnect voice traffic on efficient terms by ILECs would impose costs on competitors and deter broadband deployment.

Last, but hardly least, regulators also have broad public interest mandates under their governing statutes to ensure that Americans continue to enjoy the same quality of voice service that they historically have expected as the underlying network transitions from circuit-switching to IP.[29] Interconnection policies for next generation networks must protect and promote long-established consumer quality expectations (not to mention new applications supported by Managed Packet networks), and do so not only within the Managed Packet network of a single carrier, but also across the networks of interconnecting carriers.

Notwithstanding Verizon's rhetoric, none of this is a "radical" departure from basic telecommunications law. The Telecommunications Act accommodates AT&T's plan to "dismantle the older voice circuits" as it replaces its own network with Managed Packet technology. The Act contemplates similar evolution of other ILEC networks. And as emphasized at the outset, network interconnection oversight in no way bears on how one may or may not regulate retail voice services provided over these wholesale network meet points.

The legal footings for interconnection of Managed Packet networks are already in place. All carriers have a legal duty to interconnect their Managed Packet voice networks and provide transport and termination on a reciprocal basis. ILECs have a further responsibility under Section 251(c) to provide non-discriminatory MP-to-MP interconnection "at least equal" to that they provide themselves, and do so "at any technically feasible point" within their network. The terms of Managed Packet

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223, 20 FCC Rcd 19415, para. 1 (2005), *aff'd Qwest Corp. v. FCC*, 482 F.3d 471 (D.C. Cir. 2007).

[28] *See* 47 U.S.C. § 157 nt. (directing FCC and state utility commissions to encourage the deployment of advanced telecommunications capability to all Americans through measures that "promote competition in the local telecommunications market" and remove "barriers to infrastructure investment").

[29] *See, e.g.*, 47 U.S.C. § 151 (requiring FCC to promote efficient communications services for the public).

interconnection are subject to negotiation and arbitration under Section 252, just like interconnection of circuit-switched networks.

Section 252 is likely to play an important role in the advancement of Managed Packet services in the future. Verizon's public statements -- and more generally the history of controversy over interconnection with ILECs -- suggest that ILECs will resist their obligation to provide for the interconnection of Managed Packet networks.[30] It is not the purpose of this paper to anticipate and catalog the ways that ILECs might refuse to provide "technically feasible" interconnection for the exchange of voice traffic over Managed Packet networks. Indeed, experience shows that some ILECs are more likely to cooperate than others, and that (importantly) the scope of what is technically feasible will evolve.

This is why Section 252's arbitration provisions are such an important legal backstop to the advancement of Managed Packet networks. ILECs will know that if negotiations with competitors fail, state regulators (guided by FCC policies) will ensure that consumers receive the full promise of Next Generation networks through reasonable and cost-efficient interconnection. With that backdrop, ILEC-competitor negotiations are more likely to progress successfully. But no matter what, ILECs should not be able to deter such progress by requiring requesting carriers to make unnecessary protocol conversions prior to traffic exchange. ILECs should not be able to impose unnecessary costs on Managed Packet networks by forcing multiple interconnection points mirroring the increasingly historical circuit-switched TDM world. And ILECs should not be able to degrade voice service transported over Managed Packet networks of other competitors by refusing to exchange (or stripping) packet instructions used to assure quality of service for end users.[31]

Regulators can minimize their own long-term burden by making clear to ILECs that the replacement of circuit-switched network equipment does not relieve them of their obligations under Section 251 and 252. This principle should not be a matter of controversy and debate. Once recognized and affirmed in the context of Managed Packet networks, it can shape interconnection through the negotiation and arbitration processes

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30 A refusal to directly exchange Managed Packet voice traffic would be tantamount to the kind of blocking of traffic exchange that the Commission previously has condemned. *See Order and Consent Decree, Madison River Communications, LLC*, DA 05-543, 20 FCC Rcd 4295 (Enforcement Bureau, 2005); accord, *Memorandum Opinion and Order, Time Warner Cable Request for Declaratory Ruling that Competitive Local Exchange Carriers May Obtain Interconnection Under Section 251 of the Communications Act of 1934, as Amended, to Provide Wholesale Telecommunications Services to VoIP Providers*, 22 FCC Rcd 3513, DA 07-709 (March 1, 2007).

31 Related issues exist as to the pricing of Managed Packet interconnection, as well as of transport and termination of Managed Packet voice services. While pricing issues certainly are important in their own right, they are beyond the scope of this paper, which focuses on the need to address non-price issues facing Managed Packet interconnection.

that already are familiar to all. In this way "next generation" network deployment, and the new broadband services they permit, can proceed without jeopardizing voice service quality and competition.

V. Conclusion

There is general consensus that Managed Packet networks will replace circuit-switched technology as the architecture of choice for the provision of voice services. Although there is agreement about this end-point, to date there has been little discussion as to the path the transformation will take.

The first step is clear, with the deployment by individual carriers of Managed Packet technology that supports the voice quality and reliability that the consumers and businesses have come to expect. The result is the emergence of "Next Generation" islands, where a carrier's own network prioritizes voice-packets to meet accepted standards. However, today the traffic is converted back to its legacy form (TDM) so that it may be exchanged with the incumbent.

Obviously, this practice cannot continue indefinitely. With both entrants and incumbents deploying Managed Packet transport networks, it makes no sense to limit the interconnection needed to exchange traffic between them to facilities that have not been upgraded to new technology. Not only does this unnecessary conversion increase cost, it robs potential Managed Packet interconnection arrangements of the scale needed to accelerate further deployment of Next Generation networks by both.

The answer is equally obvious: To promote the continued expansion of Managed Packet networks, these networks should be interconnected in packet form. Such arrangements would avoid the costs of needless TDM conversions, while ensuring that the benefits of Managed Packet transport are realized as deep into the network as possible.

The basic framework of the federal Act – negotiation with the backstop of arbitration if needed – is just as appropriate to Managed Packet networks as it is to circuit-switched facilities. The Act anticipated that competition would encourage the development of new technologies, and its most core provisions (such as those addressing interconnection) were structured to adapt over time. The next step in the evolution of Next Generation transport networks is to interconnect Managed Packet networks directly, respecting the prioritization required to maintain quality voice services. The Telecommunications Act requires as much, and provides the necessary backstop against the local market power of the ILECs.